ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

*Website: www.ijareeie.com*

**Vol. 9, Issue 2, February 2020**

# Significant of Smart Grid Technology in on Grid & Off-Grid Solar-Wind Hybrid System

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**ABSTRACT**: The electricity generation using solar-wind hybrid system is best in present era because all over worlds' countries are focused on installing eco-friendly power generation system. Present time old system is replaced by new Smart grid systems. The solar-wind hybrid system is best for electricity generation but when this system connects with on & off grid system a smart grid system required.
The main objective of my research work is to analyse the significant of smart grid system, it provide alternative energy source, save the energy. To analyse the comparison between old grid system and smart grid system, Use the HOMER software for simulation & optimization of the solar-wind hybrid system and cost analysis between grid-connected & off-grid. Smart Grid technology is better than old grid system, in modern era all system required smart technology.

**KEYWORDS:** Smart Grid, HOMER, METLAB, On Grid-Off Grid, Hybrid System

## I.INTRODUCTION

India is a developing country, there are total 6, 38,596 villages in India, in which 5, 93,732 villages are inhabited. Out of 5, 93,732 villages, 5,127 villages are electrified only for some hours & rest 38605 villages are using kerosene lamp for lighting their houses. India is not economically stable as it is a developing country. As the population increases day-by-day, so the demand of electricity increases simultaneously. All the electricity is supplied in cities, industries, mills and factories. The "smart grid" is a term used to describe the rapid infrastructure replacement of the electrical wiring system in the United States. When the advanced system is completely implemented, it will allow for communication features across the grids that are not currently available--hence the term "smart". A "smart Grid" is simply an advanced electrical distribution system that has the capability to balance electrical loads from diverse, and often intermittent, alternative energy generation sources. One key component of the "Smart Grid" is the capacity to store electrical energy; this allows the demand from consumers.

The first alternating current power grid system was installed in 1886 in Great Barrington, Massachusetts. At that time, the grid was a centralized unidirectional system of electric power transmission, electricity distribution, and demand-driven control.
In the 20th century local grids grew over time, and were eventually interconnected for economic and reliability reasons. By the 1960s, the electric grids of developed countries had become very large, mature and highly interconnected, with thousands of 'central' generation power stations delivering power to major load centres via high capacity power lines which were then branched and divided to provide power to smaller industrial and domestic users over the entire supply area.In the 21st century, some developing countries like China, India and Brazil were seen as pioneers of smart grid deployment. Since the early 21st century; opportunities to take advantage of improvements in electronic communication technology to resolve the limitations and costs of the electrical grid have become apparent.

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Technological limitations on metering no longer force peak power prices to be averaged out and passed on to all consumers equally. In parallel, growing concerns over environmental damage from fossil-fired power stations has led to a desire to use large amounts of renewable energy.

## II. LITERATURE SURVEY

Literature review has helped to attain the conceptual clarity and to frame my theoretical perspective. Smart Grid &Renewable Global Status Report provides a comprehensive and timely overview of renewable energy and energy policy development worldwide, World wind energy scenario, Global investment in renewable energy, Global demand for renewable energy.

Mag. Inż. Indrajeet Prasad ‘’Smart grid technology: Applications and controls’’ is the base paper this paper given the ideas to compare the old grid system & Smart Grid system so we proposed solar-wind hybrid model used for it.

Z. Benhachani, B. Azoui, R. Abdessemed, M. Chabane–“Study the sizing and economic optimization of a stand-alone photovoltaic-wind hybrid system with storage batteries”.

Two methods are developed. The first method is based on the average annual monthly values in which the size of photovoltaic (PV) and wind generators is determined from the average monthly contribution of each component.

## III. DATA FEEDING IN HOMER

To analyse the significant of Smart Grid system in comparison with traditional grid system, we proposed a solar-wind hybrid system and for electric load select the village Umrikheda. The 24 hours data of electric load village umrikheda used for system design and these data feed in HOMER software as shown in fig. 1 below and wind data in fig.2 and solar data in fig.3 feed average month wise because the system is based on tradition model. In my thesis work this is the research point, what happen the data feed month wise and data feed present time wise.

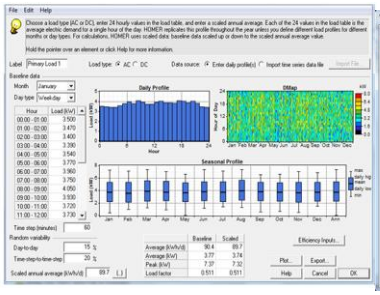

**Fig.1: Electric Load hourly**

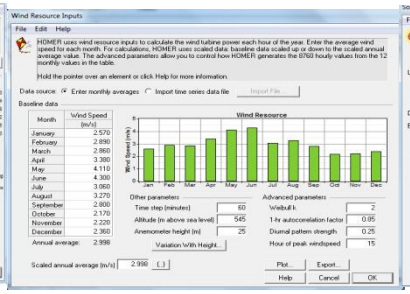

**Fig.2: Wind data month wise**

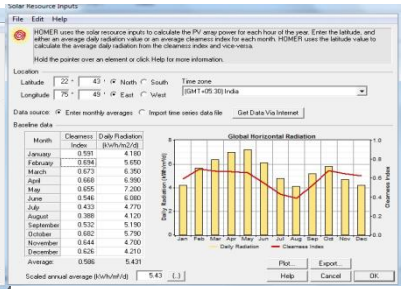

**Fig.3: Solar data month wise**

The data of electric load calculated on basis of 24 hours requirements and average data of solar-wind collected yearly month wise and these data feed in HOMER software for proposed model.

## IV.PROPOSED SYSTEMOF ON-GRID& OFF-GRID

The generation, transmission and distribution of electric energy are based on traditional system but in present era. The time required changes in electrical system so that to analyse the significant of new technology like “Smart Grid”. We survey the village Umrikheda, Indore for electric load collection there electric load fluctuate time to time and design an On-Grid & off-GridModel using HOMER software for village umrikheda.

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Table: 1 Electric Load Hourly

| TIME (HOURS) | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KW | Jan to Dec | 3.50 | 3.47 | 3.40 | 3.39 | 3.54 | 3.77 | 3.96 | 3.75 | 4.05 | 3.93 | 3.72 | 3.73 |
| TIME (HOURS) | Jan to Dec | 13 | 14 | 15 | 16 | 13 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| KW | | 3.93 | 4.03 | 3.85 | 3.87 | 3.81 | 4.08 | 4.04 | 3.89 | 4.03 | 3.80 | 3.46 | 3.40 |

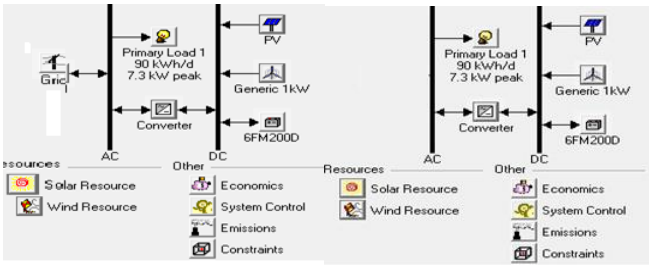


Fig.4 On-Grid Model Fig.5 Off-Grid Model

The electric power requirement of village umrikheda is around 90 kWh/day for this load, we proposed asolar-wind hybrid system using HOMER software, to analyse thesignificant of new technology like Smart Grid. Smart Grid means the data of electric load, data of power generation, data of transmission and data of distribution in present old technology calculated month wise or year wise but in smart grid technic all data calculated on present time and data updating using all digital based devices. The data of electric load may be varying season to season in tradition technic.In tradition old grid system the load forecasting is major problem. We also analyse this problem in smart grid technic to solve the problems.

In faulty condition major problem is that to find the exact faulty location, according to load variation how the react the electrical device all thesis thinks. We have to analyse in smart grid system so proposed an on-grid and off-grid model. In both systemsthe system is better than other analysed in comparison with smart grid system.

## V. SIMULATION RESULTS

The proposed solar-wind hybrid model simulates in HOMER software and generates the number of feasible combination of system with optimized result as shown in fig.6 on-grid and fig.7 off-grid. It is difficult manually to finalize the feasible combination of components, which are actually used in Installation of solar-wind hybrid system. We provide the number of different combinations to HOMER software, on the basis of different combination, HOMER calculate the solar radiation of whole year, wind speed and other devices prices.

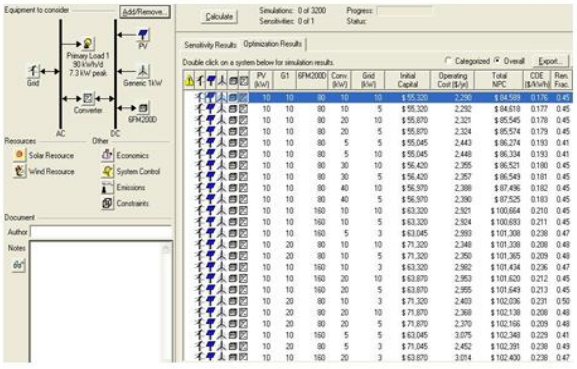

Fig.:6 Simulations results of On-Grid

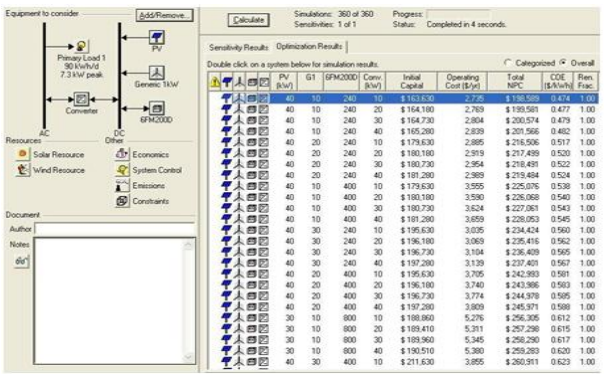

Fig.:7 Simulations results of Off-Grid

The HOMER software use the data feed by us and after simulation, display the number of feasible combination of solar-wind hybrid system and also suggest the optimized combination of system. The data in both hybrid model on-grid and off-grid feed on the basis of month wise collected data. The load demand data vary day to day but these are the traditional based hybrid system so we use month wise data. In Smart Grid system these data updated time to time using digital GPS based device. In both proposed systems on-grid and off-grid, we find the scope where data may be updated with real time, so we proposed these systems.

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Fig.8 Renewable output power on-grid

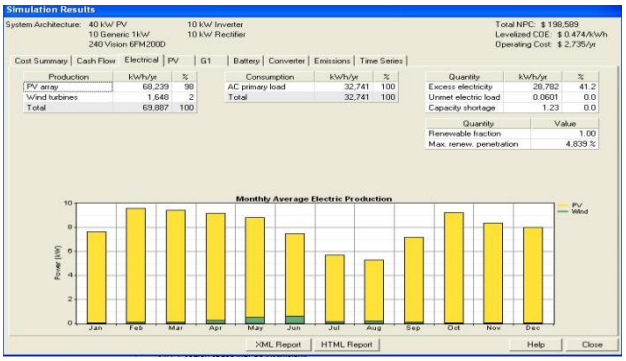


Fig.9 Renewable output power off-grid

In on-grid system 10 kW wind generator, 10 kW PV panels and 10 kW grid connections provided. The production of total renewable power output is 39389 kWh/yr. in which generation by solar 17060 kWh/yr. (43%), wind 1648 kWh/yr. (4%), and grid purchasing 20601 kWh/yr. (53%) in on grid hybrid system.

In off grid system 40 kW PV panels and 10 kW wind generator used. The production of total renewable power output in off-grid hybrid system is 69887 kWh/yr. in which generation by solar 68239 kWh/yr. (98%), wind 1648 kWh/yr. (2%) around 41% power is excess because the system off-grid system.

## VI. CONCLUSION

The old grid system uses the fix tariff system and use the single source to supply electric power. As we proposed the solar-wind hybrid system based on old grid pattern in which all the data required are month wise or year wise according to these data, we analysed the electric power generation and distribution.
We conclude this the Smart Grid system is better than old grid system in all aspect like multi supply source instead of single source as in old grid system. The data used for analysis not month wise or year wise, whereas real time data used in Smart Grid system with the help of digital based devices. Smart Grid system provides the alternative source of energy that's why continues the supply and avoid the blackout situations.

## VII. FUTURE SCOPE

The Smart Grid system technology is better than old grid technology in all respect, as multiple supply sources, real time data collection, and multiple supply tariff system. The coming era in electric power generation, transmission and distribution required the smart system. In future all devices will be converted in smart devices because smart technology not only help in power generation but also help in electric power saving.

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